Species

23(71), 2022

First Report of Ostreopsis siamensis in Syrian coastal waters (Eastern Mediterranean)

Feirouz Darwich

To Cite:
Darwich F. First Report of Ostreopsis siamensis in Syrian coastal waters (Eastern Mediterranean). *Species,* 2022, 23(71), 266-271

Author Affiliation:
Prof. Marine Bioloigy Department, High Institute of Marine Research, Tishreen University, Lattakia, Syria
Email: feirouz.darwich@tishreen.edu.sy

Peer-Review History
Received: 18 March 2022
Reviewed & Revised: 23/March/2022 to 11/May/2022
Accepted: 14 May 2022
Published: 17 May 2022

Peer-Review Model
External peer-review was done through double-blind method.

DISCOVERY SCIENTIFIC SOCIETY

ABSTRACT

The first abundant occurrence of *Ostreopsis siamensis* was observed in two stations along the Syrian coasts. The monthly and spatial variations of its density in water samples were carried out at two different stations from January to December 2018. The most important results that *O. siamensis* is present in both stations in February and March when the surface water temperature is 20,6ºC.The maximum value of *O. siamensis* reached in this period $6.2*10^6$ cells in March. The depilation of` Orthophosphates was proportionately more rapid than of Nitrate, highlighting the strong P demand of dinoflagllate *O. siamensis*.

Keywords: Eastern Mediterranean, Syria, *Ostreopsis siamensis*, nutrients

1. INTRODUCTION

In recent year, The presence of toxic algae has been observed and this has led to the accumulation of toxins in seafood have been studied in many Mediterranean countries (Zingone, 2010; Abi Saab et al., 2017; Bizselet et al., 2018, Açaf et al., 2020). Blooms of benthic dinoflagellates belonging to the genus Ostreopsis have been reported as an increasingly common phenomenon in temperate regions worldwide (Gilbert et al., 2010, Shears & Rosss, 2009; Aligizaki, 2010; Gladan et al., 2019). During the last decade, reports on the occurrence of genus Ostreopsis have been increased rapidly along eastern Mediterranean coasts: in Egyptian coast (Ismael & halim, 2006). Populations with numerous individuals of Ostreopsis species were usually recorded during the warm period, while sommer blooms of these species, detected in the Tyrrhenian and south Adriatic seas in Italian coasts have been associated with human health problems, such as respiratory and skin irritations (Sansoni *et al*., 2003; Honsell *et al*., 2011; Accoroni, 2016; Brissard *et al*., 2019; Marin-Pierre, 2020).

In Syria, until now, studies on phytoplankton have been shown no occurrence of Ostreopsis species (Darwich, 1999, Hamoud 2000; Darwich & Suliman 2010, Darwich & Al Mirei 2020).

There are extensive studies from Syria on other harmful microalgae such as those causing harmful algal blooms that were detected along the Syrian coastal waters (Darwich, 2021, Darwich & AlAkash 2021).

The aim of our current study is to look into the temporal and spatial variations of the density of *O. siamensis* in water samples and its possible relationships between abundance and environmental factors at two different sites along Syrian coast.

2. MATERIALS AND METHODS

Two stations were selected covering a part of lattakia coast; the description and position of two investigated stations are presented in Table (1) and Fig (1).

Surface water samples were collected on monthly basis in the morning from January to December 2018 at both stations. Surface water temperature (SST) and salinity (SSS) were measured by using YSI model YSI. Samples for orthophosphate (P-PO4) and nitrate (N-NO3) concentrations were analysis according to (Strickland & Parsons 1968). Standard phytoplankton net with 20-µm mesh size was used for phytoplankton sampling. Lugols's solution was added to the water samples in order to estimate the abundance of dinoflagellates in water samples using Utermoehl's method (1958). Species were determined based on international taxonomic references (Sournia, 1986, Starmach, 1989).

Spear man –non parametric-correlation matrix was applied in order to investigate possible relationship between *O. siamensis* density and environmental parameters on 12 samples from two stations using SPSS software.

Table 1. Coordinates and characteristics of two stations monitored on Latakia coastal waters

Station &code	*Locality In Syria*	*Coordinates*	*Depth (Z) and distance from the coast (D)*
ST1	North	E 35º 45' 31 68 N 35º 36 36 52	Z=0.5m D=50m
ST2	North	E 35º 44' 84'' N 35º 35 36 55	Z=0.5m D=2km

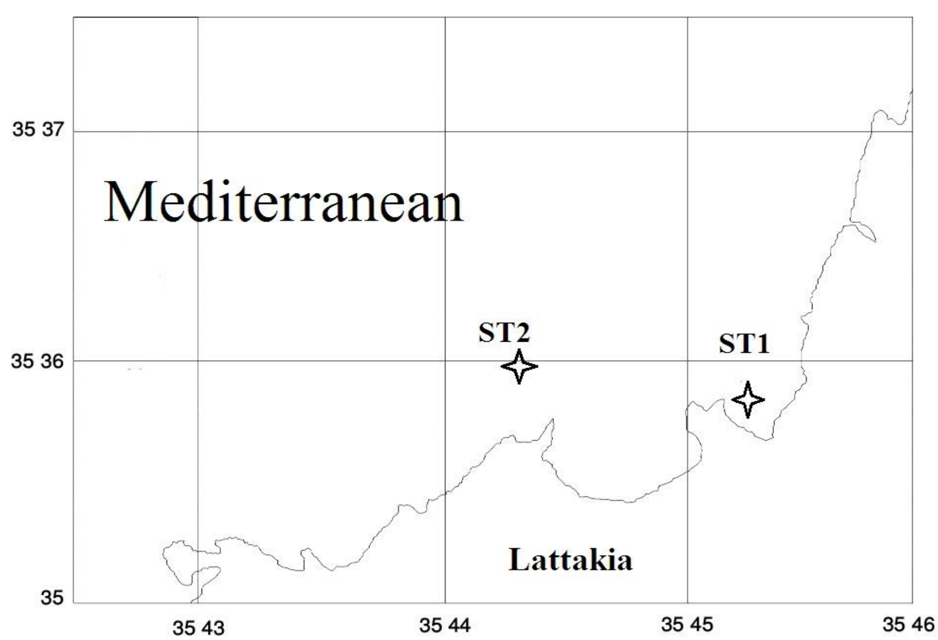

Fig (1) Location of sampling stations.

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

3. RESULTS AND DISCUSSION

During the study period, in all sampling stations, the values of sea surface temperature varied between 17 ºC in January (ST2) to a maximum 29.5 ºC in August (ST2). For Nitrate concentrations, the values vary from 0.2µM/L in July at ST2 to 9.1 µM/Lin January at ST1 (Table. 1). The values of orthophosphate ranged between 0.002 µM/L in June at ST2 and 1.1µM/L in January at ST1 (Table 2).

Table 2. Descriptive statistics (Minimum and Maximum values) of the parameter measured at two stations between January and December 2018 in the Syrian coastal waters.

Station parameters	*ST1* *Min-Max*	*ST2* *Min-Max*
SST (Cº)	17.5-29	17-29.5
N-NO3(µM/L)	9.1-0.4	6-0.2
P-PO4 (µM/L)	0.007-1.1	0.002-0.6
N/P ratio	2.5-185	2.6-542

Blooms of *Ostreopsis siamensis* was detected in both studying stations. The abundance of *O. siamensis* varied between zero at both stations and 6.2 * 10^6cell/L at ST1in March Fig (2).

Seasonal changes in *O. siamensis* abundance showed one major peak in March in both stations (6.2 and 1.1 *10^6cell\L respectively). The highest abundance of *O. siamensis* was found in station1, when the surface Sea water temperature was 20.6ºC. *O. siamensis* was observed only in February and March in both coastal stations, while it disappeared in all other months (Fig.2).Our data show that the peak in bloom abundance was found to occur in the early spring when the temperature was increasing from seasonal minmum (17 ºC) and water temperatures were higher (20.6 ºC) in the bloom of *O. siamensis*.

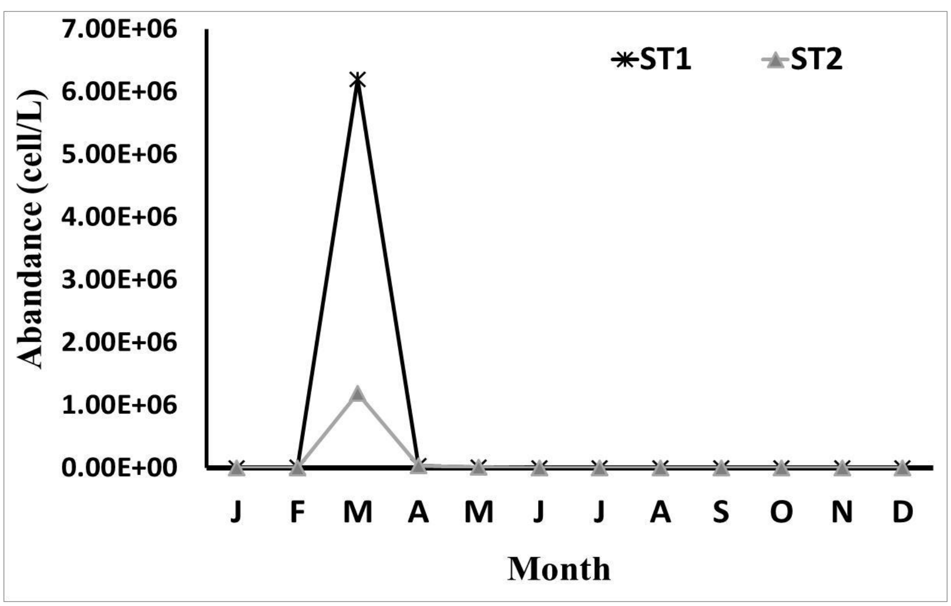

Fig (2). Monthly variations of the abundance of *Ostreopsis siamensis* from January to December 2018 at two Stations (ST1, ST2).

In this study, *O. siamensis* was detected in water only in February and March and the highest densities were reordered simultaneously with the increase of water temperature and the available of nutrients (NO_3, PO_4) in both sampling stations. Blooms of *O. siamensis* were occurred in a condition of elevated N: P ratios, well above Redfield proportions (N: P=542) (Table2), a condition

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

normally taken to be indicative of P limitation. Interestingly, the bloom of *O. siamensis* leads to almost P depletion in sampling water.

The differences in *O. siamensis* abundance among stations was also significant ($p<0.01$), higher abundance was observed at station 1 due to the direct influence of continental discharges in its vicinity that are loaded with fertilizers and other domestic waste, (Aligizaki, 2018; ISPR, 2017). Recent studies have provided more evidences of a link between nutrient enrichment of coastal waters (anthropogenic eutrophication) and harmful algal event (Pezzolesi *et al*., 2012, Pezzolesi *et al.*, 2014, Vila *et al*., 2016, Accoroni *et al*., 2017). However, there is very limited information on relationships between nutrient concentrations and trend in development of benthic dinoflagellates blooms *O. siamensis*. In NM Mediterranean Sea (Shears & ross, 2009; Giussani *et al*., 2014, Mangialajo *et al*., 2011,Satta *et al*., 2018) did not find any relations between *O. siamensis s*and nutrients, while (Pasron & Preskitt, 2007) found that *Ostreopsis* abundance was positively correlated with all inorganic nutrients concentrations in the waters. Our results find that the bloom cells of *O. siamensis* consumed nutrients especially phosphate, There was no relationship was found between nutrient concentrations and *O. siamensis* abundances. In this study *O. siamensis* achieve maximum growth rates at N:P above Redfield proportions (Zhang & Hu, 2011, Glibert et al., 2010, Glibert et al., 2012). It was found that in the bloom onset period PO_4 concentrations were significantly lower than in pre-bloom conditions. Both (Vanucci et al., 2012, Pezzolesi et al., 2014) found that the depilation of` P was proportionately more rapid than of N, highlighting the strong P demand of this dinoflaglIates.

However, other factors both biotic and abiotic, such as ability to use organic forms of nutrients and interactions with other organisms, should be investigated to further clarify the *Ostreopsis siamensis* natural bloom mechanism. Actually, many HAB genera can use organic (dissolved or particulate) forms of nutrients for their nutritional demands (Cucchiari et al., 2008, Ben-Gharbia et al, 2016; Tartaglione, 2017, Penna et al., 2018).

4. CONCLUSION

In conclusion, our data suggest that in Syrian coastal water Ostreopsis blooms was triggered by combination of calm hydrodynamic conditions, optimal temperature and favorable nutrients. Calm conditions are a prerequisite for bloom, and only when this condition exists do temperature and nutrient start to have a decisive effect. This preliminary study presents a baseline for future studies. Further studies should consider benthic sampling.

Acknowledgment

Special thanks go to the department of Marine research at high institute of marine research and to the anonymous reviewers for their valuable comments.

Ethical approval

Ostreopsis siamensis was observed in the study from in Syrian coastal waters (Eastern Mediterranean). The Animal ethical guidelines are followed in the study for species observation & identification.

Funding

This study has not received any external funding.

Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Abi Saab, M., et al. (2017). Effects of organic pollution on environmental conditions and the phytoplankton community in the central Lebanese coastal waters with special attention to toxic Algae. Regional Studies in Marine Science, 10, 38-51pp.
2. Açaf1, L., et al. (2020)." Bloom dynamics of the newly described toxic benthic dinoflagellate *Ostreopsis fattorussoi* along the Lebanese coast (Eastern Mediterranean)." Elsevier.

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

3. Accoroni, S., et al. (2016). "Ostreopsis fattorussoi sp. nov. (Dinophyceae), a new benthic toxic Ostreopsis species from the eastern Mediterranean Sea. 52(6)1064-1084.
4. Accoroni, S., et al. (2017). "The toxic benthic dinoflagellates of the genus Ostreopsis in temperate areas: A review. Adv, Vol. 7 No. 1.
5. Aligizaki, K., *et al*. (2018). "A First episode of shellfish contamination by palytoxin-like compounds from Ostreopsis species (Aegean Sea, Greece)." Toxicon 1; 51(3):418-27.
6. Ben-Gharbia, H., et al. (2016). "Toxicity and growth assessments of three thermophilic benthic dinoflagellates (Ostreopsis cf. ovata, Prorocentrum lima and Coolia monotis) developing in the Southern Mediterranean basin. Toxins 15; 8(10):297.
7. Bizsel, N., et al. (2018). "Detection of Ostreopsis cf. ovata in coastal waters of Turkey (East Aegean Sea)".In Proceedings of the International Conference on Ostreopsis Development p. 53.
8. Brissard, C., et al. (2019). "Complex toxin profile of French Mediterranean Ostreopsis cf. ovata strains, seafood accumulation and ovatoxins prepurification". Mar. Drugs 2014, 12, 2851–2876. [CrossRef] Toxins, 11, 300 21 – 22.
9. Cucchiari, E., et al. (2008). "Effect of salinity temperature organic and inorganic nutrients on growth of f cultured *Fibrocapsa japonica* (Raphidophyceae) from the northern Adriatic Sea." Harmful Algae. 7(4) 405-414.
10. Darwich, F. (1999). "A contribution to study phytoplankton in coastal water of Banias. Tishreen University. Thesis Submitted for M.Sc Degree of science in Aquatic Environment 156pp.
11. Darwich, F., et al. (2012). ". Influence of Nutrients on phytoplankton Growth in Lattakia coastal water. Journal for Research and Scientific Studies Vol. (34) No. (6).
12. Darwich, F., et al. (2021). "Temporal and Spatial changes of phytoplankton in the coastal waters of Banias city." Tishreen University Journal for Research and Scientific Studies - Biological Sciences Series Vol. (24) No. (6).
13. Darwich, F., et al. "Studying the changes in chlorophyll a concentrations related to some hydrological factors in north coastal waters of Lattakia city eastern Mediterranean." Asian Journal of Advances in Research 11(4): 200-204.
14. Galdan, Z., et al. (2019). "Massive occurrence of the Harmful Benthic Dinoflagellate Osteriopsis cf. Ovata in the Eestern Adriatic Sea". Toxins *11*(5) 300.
15. Glibert, P.M., et al. (2010). "Modeling of HABS and eutrophication status advances challenges." J.Mar.Syst.83 (3-4) 262-275.
16. Glibert, P.M., et al. (2012). "Recent insights about relationships between nutrient availability, forms, and stoichiometry, and the distribution ecophysiology, and food web effects of pelagic and benthic *Prorocentrum* species" Volume 14 Pages 231-259.
17. Giussani, V., el al. (2014). "New Ostreopsis species recorded along Cyprus coasts: Toxic effect and preliminary characterization of chemical-molecular aspects." Marine and Freshwater Harmful Algae Proceedings of the 16th International Conference on Harmful. Algae. Cawthron Institute, Nelson, New Zealand and the International Society for the Study of Harmful Algae (ISSHA).
18. Hamoud, N. (2000). "Studying the distribution of phytoplankton under the influence of some environmental factors in the coastal waters of Lattakia city." Journal for basic science.16 207-223.
19. Honsell, G., et al. (2011). "Harmful dinoflagellate Ostreopsis cf. ovata Fukuyo: Detection of ovatoxins in field samples and cell immunolocalization using Antipalytoxin Antibodies. Environ. Sci. Technol. 45,16, 7051–7059.
20. Ismail, A., et al. (2012). "Potentially harmful Ostreopsis spp. in the coastal waters of Alexandria – Egypt." Mediterranean Marine Science Vol 13, No 2.
21. ISPRA, (2017)." Monitoraggio della microalgae potenzialmente tossica Ostreopsis cf. ovata lungo le coste italiane. Istituto Superiore per la Protezione e la Ricerca Ambientale.
22. Marin-Pierre, G., et al. (2020). "Toxin content of Ostreopsis cf. ovata depends on bloom phases, depth and macroalgal substrate in the NW Mediterranean Sea". Harmful Algae Volume 92 101-727 9p.
23. Parsons, M.L., et al. (2007). "A survey of epiphytic dinoflagellates from the coastal waters of the island of Hawaii. Harmful Algae 6(5).658-669.
24. Penna, A., (2018). "Mitochondrial, but not rDNA, genes fail to discriminate dinoflagellate species in the genus Ostreopsis." Harmful Algae. 40, 40–50.
25. Pezzolesi, L., et al. (2012). "Influence of temperature and salinity on Ostreopsis cf. ovata growth and evaluation of toxin content through HR LC-MS and biological assays." Water Res1; 46(1):82-92.
26. Pezzolesi, L., et al. (2014). "Growth dynamics in relation to the production of the main cellular components in the toxic dinoflagellate *Ostreopsis* cf. *ovate."Harmful Algae. Volume 36 1-10.*
27. Satta, C.T., et al. (2018). "Assessment of harmful algal species using different approaches: The case study of the Sardinian coasts." AIOL 5, 60–78.
28. Sansoni, G., et al. (2003). "Harmful algal blooms in Italy and their health effects in the population. Biologica Ambiente 17 (1) 17-23.
29. Shears, N., *et al*. (2009). "Blooms of benthic dinoflagellates of the genus Ostreopsis; an increasing and ecologically

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS

important phenomenon on temperate reefs in New Zealand and Worldwide". Harmful Algae (8): 916-925.

30. Sournia, A., *et al*. (1986). "Atlas du Phytoplankton Martin. Introduction, Cyanophycees. Dictyochophycées et Raphidophycées. Centre National de la Recherché Scientifique, Paris Éditions du Centre National de la Recherché Scientifique, 216 p.
31. Starmach, K., et al. (1989). "Plankton róslinny wód slødkich." Kluz 400pp
32. Tartaglione, L., et al. (2017). "Variability in Toxin Profiles of the Mediterranean Ostreopsis cf. ovata and in Structural Features of the Produced Ovatoxins." Environ. Sci. Technol. 51(23) 13920-13928.
33. Vanucci, S., et al. (2012). "Nitrogen and phosphorus limitation effects on cell growth, biovolume, and toxin production in *Ostreopsis* cf. *ovate." Harmful Algae volume 15 78-90.*
34. Vila, M., et al. (2016). "Establishing the link between Ostreopsis cf. ovata blooms and human health impacts using ecology and epidemiology." Sci. 80, 107–115.
35. Zhang, Q., et al. (2011). "Effect of nitrogen to phosphorus ratios on cell proliferation in marine micro algae." Chin.J.Oceanol.Lamnol.29, 739-745.
36. Zingone, A. (2010). "Harmful algal blooms in the Mediterranean: An historical overview". In: F. Briand (Ed.), CIESM Workshop Monographs CIESM, Phytoplankton response to Mediterranean environmental changes. N° 40, Monaco, pp. 19-24.

ISSN 2319–5746 EISSN 2319–5754 I OPEN ACCESS